

Name: \_\_\_\_\_

Example 1: An electronics company produces digital audio players and phones. A sign on the company bulletin board is shown.

If at least 2000 items must be produced per shift, how many of each type should be made to minimize costs?

The company is experiencing limitations, or constraints, on production caused by customer demand, shipping, and the productivity of their factory. A system of inequalities can be used to represent these constraints.

Keeping Costs Down: We Can Do It!			
Our Goal: Production per Shift			
Unit	Minimum	Maximum	Cost per Unit
Audio	600	1500	\$55
Phone	800	1700	\$95

### *Optimization with Linear Programming*

**Step 1:**

Define the variables.

**Step 2:**

Write a system of inequalities.

**Step 3:**

Graph the system of inequalities.

**Step 4:**

Find the coordinates of the vertices of the feasible region.

**Step 5:**

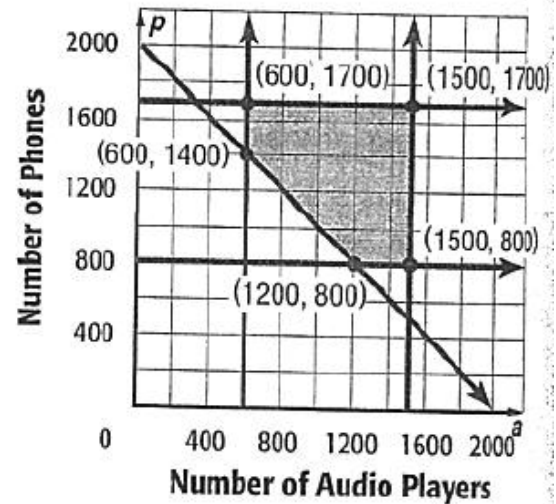
Write a linear function to be maximized or minimized.

**Step 6:**

Substitute the coordinates of the vertices into the function.

**Step 7:**

Select the greatest or least result.  
Answer the problem.



Example 2: Each week, Mackenzie can make 10 to 25 necklaces and 15 to 40 pairs of earrings. If she earns profits of \$3 on each pair of earrings and \$5 on each necklace, and she plans to sell at least 30 pieces of jewelry, how can she maximize profit?

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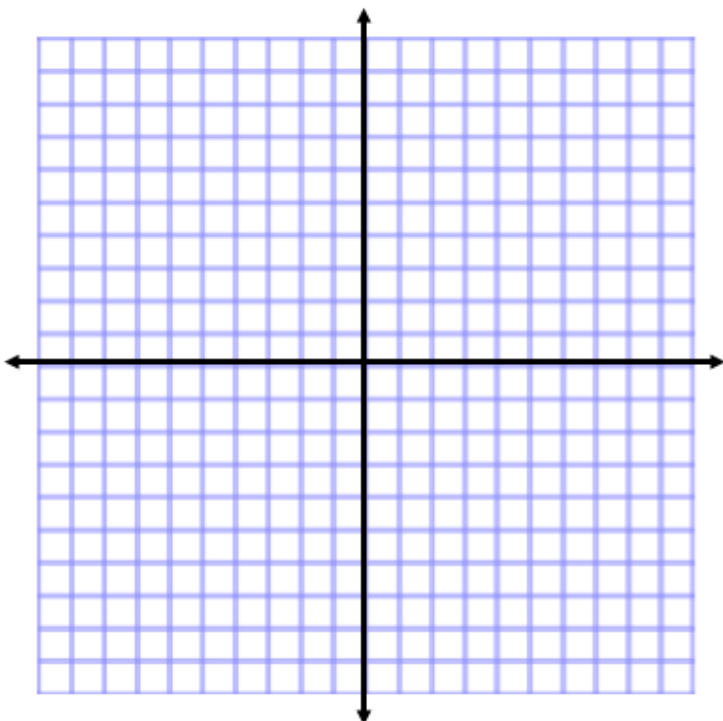
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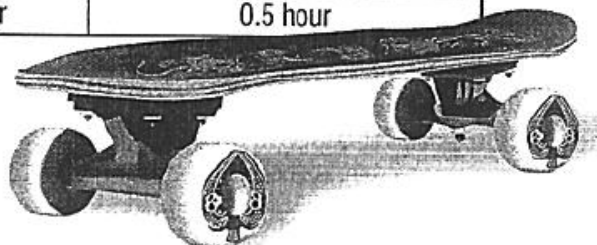
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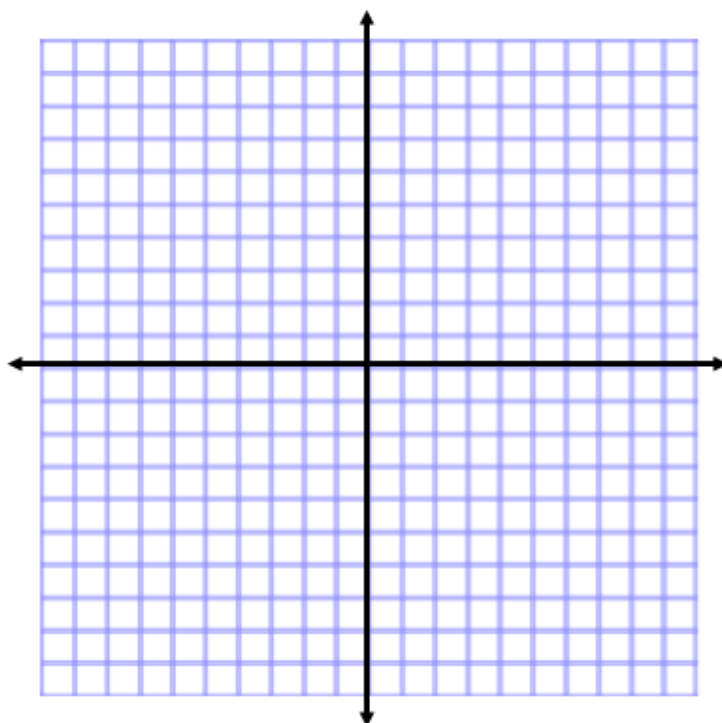


Example 3: The total number of workers' hours per day available for production in a skateboard factory is 85 hours. There are 40 hours available for finishing decks and quality control each day. The table shows the number of hours needed in each department for two different types of skateboards.

Skateboard Manufacturing Time		
Board Type	Production Time	Deck Finishing/Quality control
Pro Boards	1.5 hours	2 hours
Specialty Boards	1 hour	0.5 hour



- Write a system of inequalities to represent the situation.
- Draw a graph showing the feasible region.
- List the coordinates of the vertices of the feasible region.
- If the profit on a pro board is \$50 and the profit on a specialty board is \$65, write a function for the total profit on the skateboards.
- Determine the number of each type of skateboard that needs to be made to have a maximum profit. What is the maximum profit?



Example 4: A publishing company publishes a total of no more than 100 books every year. At least 20 of these are nonfiction, but the company always publishes at least as much fiction as nonfiction. Find a system of inequalities that describes the possible numbers of fiction and nonfiction books that the company can produce each year consistent with these policies. Graph the solution set.

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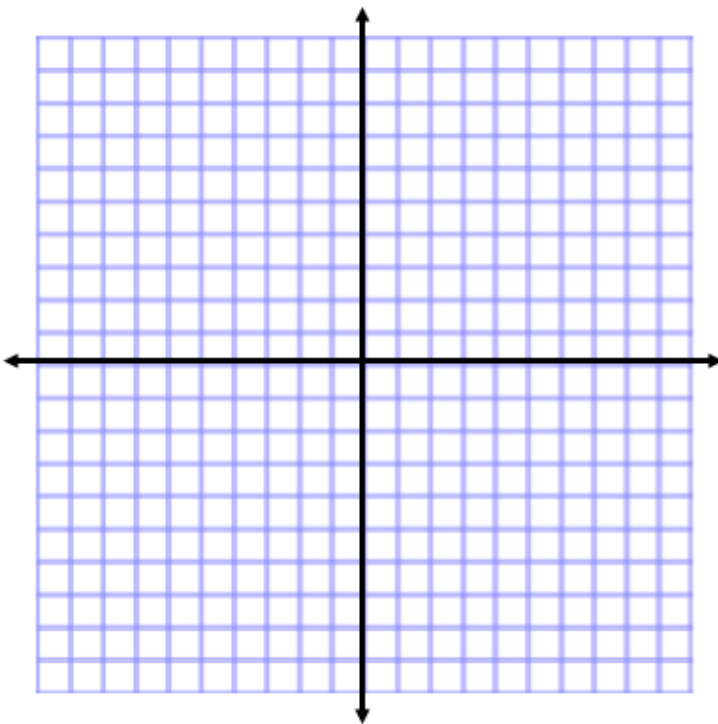
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Example 5: A man and his daughter manufacture unfinished tables and chairs. Each table requires 3 hours of sawing and 1 hour of assembly. Each chair requires 2 hours of sawing and 2 hours of assembly. The two of them can put in up to 12 hours of sawing and 8 hours of assembly work each day. Find a system of inequalities that describes all possible combinations of tables and chairs that they can make daily. Graph the solution set.

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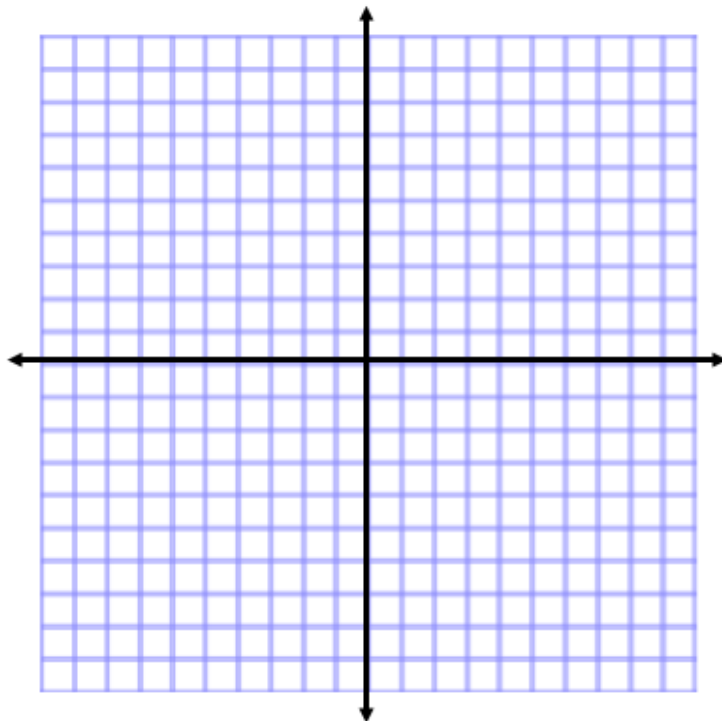
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Example 6: A furniture manufacturer makes wooden tables and chairs. The production process involves two basic types of labor: carpentry and finishing. A table requires 2 hours of carpentry and 1 hour of finishing, and a chair requires 3 hours of carpentry and  $\frac{1}{2}$  hour of finishing. The profit is \$35 per table and \$20 per chair. The manufacturer's employees can supply a maximum of 108 hours of carpentry work and 20 hours of finishing work per day. How many tables and chairs should be made each day to maximize profit?

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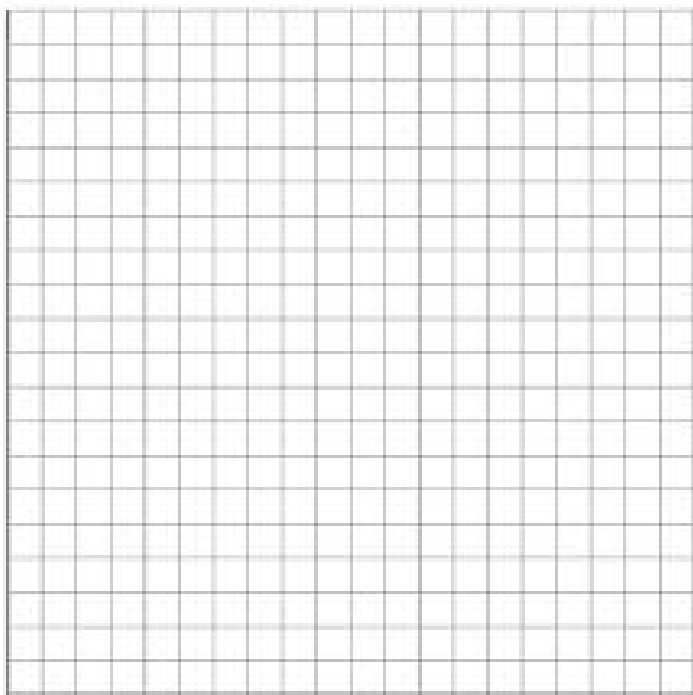
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Example 7: A housing contractor has subdivided a farm into 100 building lots. He has designed two types of homes for these lots: colonial and ranch style. A colonial requires \$30,000 of capital and produces a profit of \$4000 when sold. A ranch-style house requires \$40,000 of capital and provides an \$8000 profit. If he has \$3.6 million of capital on hand, how many houses of each type should he build for maximum profit? Will any of the lots be left vacant?

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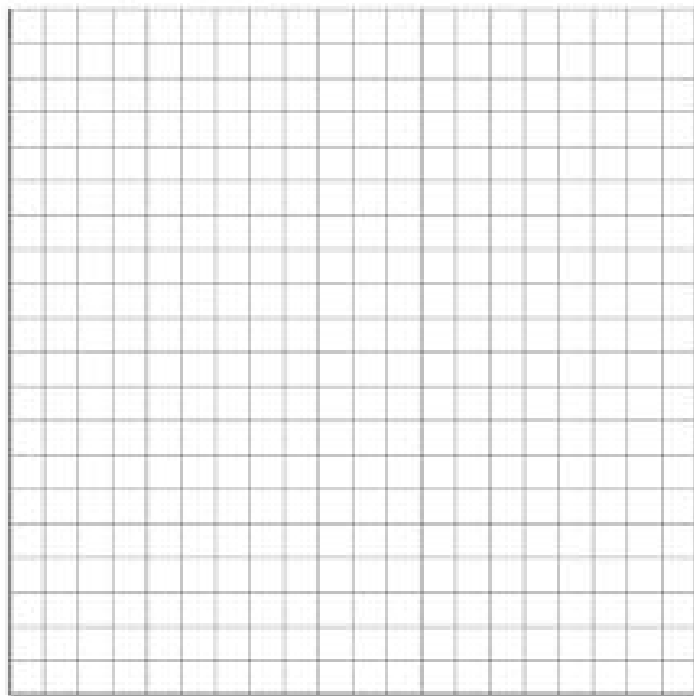
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Example 8: A small software company publishes computer games and educational and utility software. Their business strategy is to market a total of 36 new programs each year, with at least four of these being games. The number of utility programs published is never more than twice the number of educational programs. On average, the company makes an annual profit of \$5000 on each computer game, and \$8000 on each educational program, and \$6000 on each utility program. How many of each type of software should they publish annually for maximum profit?

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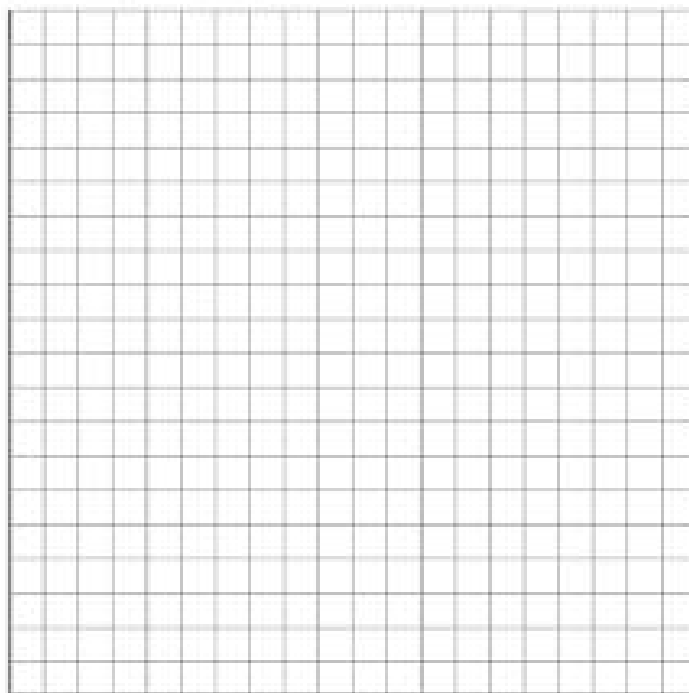
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Example 9: An electronics discount chain has a sale on a certain brand of stereo. The chain has stores in Santa Monica and El Toro and warehouses in Long Beach and Pasadena. To satisfy rush orders, 15 sets must be shipped from warehouses to the Santa Monica store, and 19 must be shipped to the El Toro store. The cost of shipping a set is \$5 from Long Beach to Santa Monica, \$6 from Long Beach to El Toro, \$4 from Pasadena to Santa Monica, and \$5.50 from Pasadena to El Toro. If the Long Beach warehouse has 24 sets and the Pasadena warehouse has 18 sets in stock, how many sets should be shipped from each warehouse to each store to fill the orders at a minimum shipping cost?

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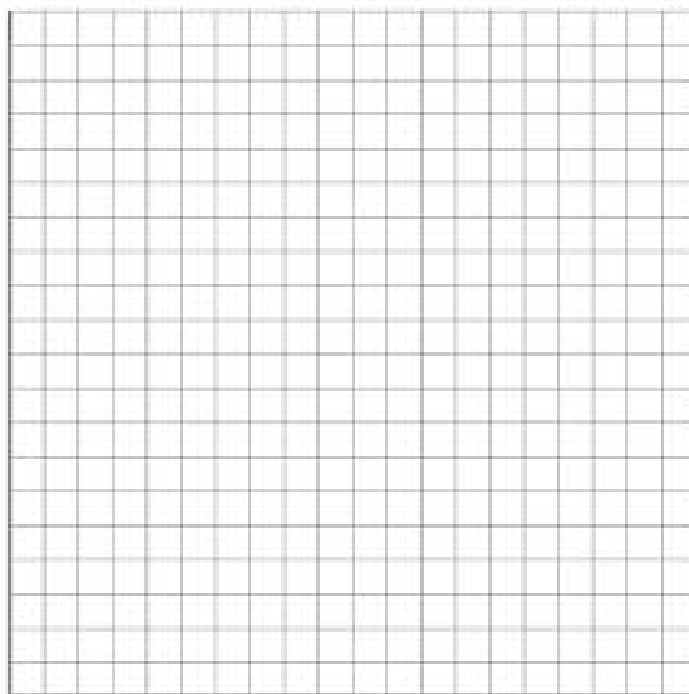
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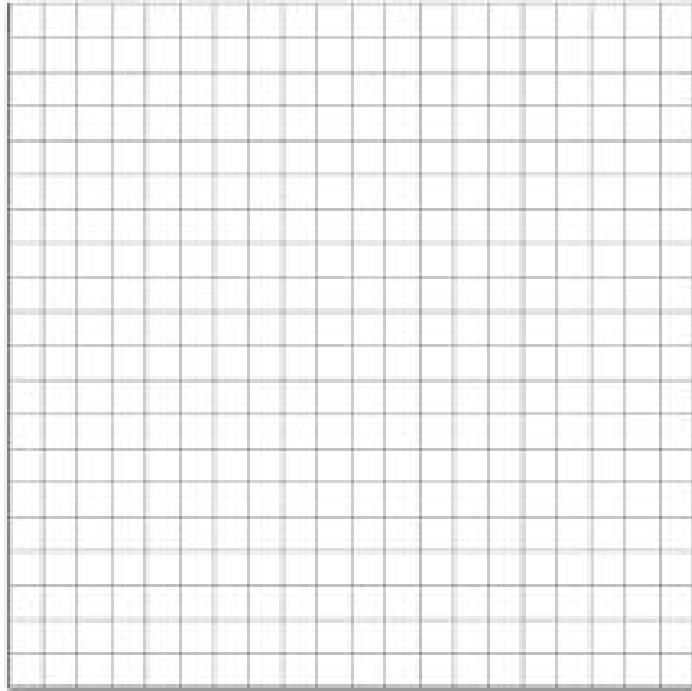
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Example 10: Each car on a freight train can hold 4200 pounds of cargo and has a capacity of 480 cubic feet. The freight service handles two types of packages: small – which weigh 25 pounds and are 3 cubic feet each, and large – which are 50 pounds and are 5 cubic feet each. The freight service charges \$5 for each small package and \$8 for each large package.

- a. Find the number of each type of package that should be placed on a train car to maximize revenue.
- b. What is the maximum revenue per train car?



Example 11: A recycling plant processes used plastic into food or drink containers. The plant processes up to 1200 tons of plastic per week. At least 300 tons must be processed for food containers, while at least 450 tons must be processed for drink containers. The profit is \$17.50 per ton for processing food containers and \$20 per ton for processing drink containers. What is the profit if the plant maximizes processing?

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